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EXAMINER	
DHINGRA, RAKESH KUMAR	

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1792	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/519,724	Applicant(s) LAERMER, FRANZ	
	Examiner RAKESH DHINGRA	Art Unit 1792	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *03* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *10 August 2009*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *14-28* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *14-28* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *28 December 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *06/16/09*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

Applicant's arguments with respect to claims 14-26 have been considered and comments are given hereunder.

Applicant has amended claim 14 by adding new limitations like “a first gas, a second gas selected to react with the first gas to form chlorine trifluoride when under the influence of a high-density plasma”. Further applicant has added new claims 27, 28.

Accordingly claims 14-28 are now pending and active.

References by Suto et al and Yanagisawa et al when combined still read on limitations of amended claim 1. Accordingly, claims 14, 16-19 have been rejected under 35 USC 103 (a) as explained below. Further regarding claim 20, in response to applicant’s argument of insufficient support for inherent production of inter-halogen, reference by Walter et al (US 3,354,646) has been cited as evidence, since it teaches generation of chlorine trifluoride when fluorine and chlorine molecules are subjected to glow discharge (e.g. col. 1, line 40 to col. 4, line 55). Thus, Suto et al in view of Yanagisawa et al and as evidenced by Walter et al teach all limitations of claim 20 as explained below and the rejection is maintained. Balance claims 15, 21-28 have also been rejected as explained below.

Regarding claim 19, in response to applicant’s argument that claim limitation pertaining to generation of chlorine trifluoride should be evaluated and considered like any other limitation, examiner responds that since prior art apparatus of Suto et al in view of Yanagisawa et al is meets structural limitations of claim 14, the apparatus of prior art is considered capable of meeting the functional limitation, and the rejection is maintained.

Additionally, in view of comments given above regarding claims 14 and 20, rejection of claims 15, 21, 23,-26 is also maintained.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claim 14, 16-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Suto et al (NPL – Highly Selective Etching of Si3N4 to SiO2 Employing Fluorine and Chlorine Atoms Generated by Microwave Discharge – J. Electrochem. Soc., Vol. 136, No. 7, July 1989) in view of Yanagisawa et al (US PGPUB No. 2001/0007275).

Regarding Claims 14, 16: Suto et al teach a microwave plasma (high density plasma) etching apparatus (shown in Figure 1) for processing wafers comprising a plasma reactor (quartz tube) wherein a first gas (NF3) and a second gas (Cl2) selected to react with the first gas under the influence of high density plasma, are supplied to the plasma generating chamber (quartz tube) for carrying out etching on a silicon wafer. Suto et al further teach that etching is based upon the microwave plasma generated species of fluorine and chlorine that are supplied to a reaction chamber via a gas outlet. Suto et al also teach that during plasma discharge, F and Cl

atoms and inter-halogen molecules are generated which are then transported into the reaction chamber (e.g. Fig. 1 and pages 2032-2034).

Further, the applicant has invoked 35 USC 112 sixth paragraph in respect of claim limitations a) "plasma generating means" as included in specification at page 11, lines 10-37 {including a microwave waveguide 150, magnetron 170, terminator 180, circulator 160, tuner 155) and b) gas supply means as included in specification at page 4, lines 25-30 {including gas bottles 21, 25 and mass flow regulators 22, 26).

Suto et al teach plasma generating means comprising of a microwave plasma apparatus but do not explicitly teach details of the same like waveguide, tuner, terminator etc. Also though Suto et al teaches supplying a first gas (NF3) and a second gas (Cl2) to plasma generating chamber, but Suto et al do not explicitly teach gas supply means comprising gas bottles and mass flow regulators. However use of microwave plasma apparatus for plasma etching and comprising waveguide, tuner, terminator etc and gas bottles and mass flow regulators is known in the art as per reference cited hereunder.

Yanagisawa et al teach a plasma apparatus (Figure 1) comprising:

A discharge tube 2 (plasma reactor) with plasma generating means (including magnetron 10, waveguide 11 with tuner 14, isolator (normally includes circulator) 15 and reflection plate (terminator) 13, by which plasma can be generated in the discharge tube 2, gas supply means (including gas bombs 31, 32, 33 and gas flow controllers 34, 35, 36) via which a first and a second gas are supplied to the discharge tube 2 (plasma reactor), and reactive species generated due to reaction of two gases under high density plasma, are supplied to the process chamber via the gas pipe 20 at its outlet 20a (paragraphs 0044-0053).

Thus, the structure of the prior art apparatus of Suto et al in view of Yanagisawa et al as disclosed above is equivalent to the plasma generating means and the gas supply means as disclosed by the applicant. It would be obvious to provide the plasma generating means of Suto et al with items like tuner, terminator, circulator etc and the gas supply means comprising items like gas bottles and mass flow controllers, as taught by Yanagisawa et al as known means for use in microwave plasma apparatus for generating high density microwave plasma. Since the prior art apparatus of Suto et al in view of Yanagisawa et al meets all the structural limitations of the claim, and is equivalent to the applicant's disclosed apparatus, the prior art apparatus of Suto et al in view of Yanagisawa et al is considered capable of generating chlorine tri-fluoride as claimed (when the structure recited in the reference is substantially identical to that of the claims, claimed functions are presumed to be inherent – MPEP 2112.01) .

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to provide plasma generating means comprising items like tuner, terminator, circulator etc and the gas supply means comprising items like gas bottles and mass flow controllers as taught by Yanagisawa et al in the apparatus of Suto et al as known means for use in microwave plasma apparatus for generating plasma.

In this connection courts have ruled:

The selection of a known material based on its suitability for its intended use supported a prima facie obviousness determination in Sinclair & Carroll Co. v. Interchemical Corp., 325 U.S. 327, 65 USPQ 297 (1945)

Additionally, claim limitations "device for generating chlorine trifluoride", "to form chlorine trifluoride" and "formed chlorine trifluoride" are intended use limitation, and since the

prior art apparatus meets all the structural limitations of the claim, the same is considered capable of meeting the intended use limitation.

In this connection courts have ruled:

A claim containing a “recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus” if the prior art apparatus teaches all the structural limitations of the claim. *Ex parte Masham*, 2 USPQ2d 1647 (Bd. Pat. App. & Inter. 1987).

Regarding Claim 17: Suto et al teach the plasma reactor includes a quartz tube. Further, Yanagisawa et al teach the plasma reactor includes a tube 2 made from aluminum oxide (para. 0049).

Regarding Claim 18: Yanagisawa et al teach gas supply means with flow controllers 34, 35, 36 by which the quantities of first and second gases supplied are adjustable (para. 0050, 0063).

Regarding Claim 19: Suto et al in view of Yanagisawa et al teach all limitations of the claim (as already explained above under claim 14) including the apparatus having a process chamber with a wafer to be processed, and where the wafer is exposed to the plasma species generated by the device. Further, claim limitation “exposed to the gaseous chlorine trifluoride” is an intended use limitation, and since the prior art apparatus meets all the structural limitations of the claim, the same is considered capable of meeting the intended use limitation (relevant case law already cited above under claim 14).

Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Suto et al (NPL – Highly Selective Etching of Si3N4 to SiO2 Employing Fluorine and Chlorine Atoms

Generated by Microwave Discharge – J. Electrochem. Soc., Vol. 136, No. 7, July 1989) in view of Yanagisawa et al (US PGPUB No. 2001/0007275) as applied to claims 14, 16-20, 22 and further in view of Ye et al (US 5,756,400).

Regarding Claim 15: Suto et al in view of Yanagisawa et al teach all limitations of the claim including a method using microwave plasma (high density plasma) apparatus but do not teach the plasma generating means comprise a coil, matching network and a high frequency generator.

Use of a RF coil for generating a high density plasma is known in the art for plasma processing as per reference cited hereunder.

Ye et al teach a method for dry-clean etching of chamber internal surfaces, wherein a first gas (fluorine containing gas) and a second gas (chlorine containing gas) are introduced in a high density inductively coupled plasma reactor comprising a coil 40, matching network 30 and a high frequency generator 28 (e.g. Fig. 2 and col. 7, line 10 to col. 8, line 5 and col. 11, line 62 to col. 15, line 15).

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to use the plasma generating means including a coil, a matching network and a RF generator as taught by Ye et al in the apparatus and method of Suto et al in view of Yanagisawa et al as a known means of generating high density plasma for semiconductor wafer processing.

In this connection courts have ruled:

> An express suggestion to substitute one equivalent component or process for another is not necessary to render such substitution obvious. *In re Fout*, 675 F.2d 297, 213 USPQ 532 (CCPA 1982).

Claims 20- 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over of Suto et al (NPL – Highly Selective Etching of Si3N4 to SiO2 Employing Fluorine and Chlorine Atoms Generated by Microwave Discharge – J. Electrochem. Soc., Vol. 136, No. 7, July 1989) in view of Yanagisawa et al (US PGPUB No. 2001/0007275) and further as evidenced by Walter et al (US 3,354,646).

Regarding Claims 20-22: Suto et al in view of Yanagisawa et al teach all limitations of the claim (as explained above under claim 14) including a method wherein a first gas (NF3) and a second gas (Cl2) react with one another under the influence of high density plasma. Suto et al further teach that during plasma discharge, F and Cl atoms and inter-halogen molecules (like FCl) are generated which are then transported into the reaction chamber (e.g. Suto et al - Fig. 1 and pages 2032-2034).

Suto et al in view of Yanagisawa et al do not explicitly teach that the prior art method generates chlorine trifluoride.

Further, though Suto et al in view of Yanagisawa et al do not explicitly teach that the method produces chlorine trifluoride, the prior art method would inherently produce chlorine trifluoride, since in such a reaction, few molecules of various reactive species including ClF3 would also be inherently produced besides FCl, especially since the claim does not recite any specific process conditions like relative gas flows of the two gases etc, except for use of a microwave plasma apparatus and use of two gases, which are also disclosed by the prior art apparatus and method of Suto et al in view of Yanagisawa, including use of same gases (viz. NF3 and Cl2) as also disclosed by the applicant, and further also as evidendenced by the reference cited hereunder.

Walter et al teach a method using plasma discharge using a first gas (F2) and a second gas (Cl2) which react with one another under the influence of plasma discharge to generate ClF3 (besides ClF5). Walter et al also teach that besides other factors, relative concentrations of fluorine and chlorine atoms should be such as to enable production of ClF5 and preferably there should be excess of fluorine {e.g. col. 1, line 40 to col. 4, line 55). Since Suto et al teach that under the action of high density plasma interhalogen molecules are produced when a first gas (containing fluorine atoms) and a second gas (containing chlorine atoms) are supplied to the plasma tube, it would have been obvious to generate chlorine trifluoride in the apparatus of Suto et al in view of Yanagisawa et al, by controlling process parameters like flow rates of the two gases etc, in view of teaching of Walter et al.

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to use control process parameters like flow rates of the first and the second gases etc as taught by Walters et al in the apparatus of Suto et al in view of Yanagisawa et al to enable generate chlorine trifluoride.

Claims 23, 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over of Suto et al (NPL – Highly Selective Etching of Si3N4 to SiO2 Employing Fluorine and Chlorine Atoms Generated by Microwave Discharge – J. Electrochem. Soc., Vol. 136, No. 7, July 1989) in view of Yanagisawa et al (US PGPUB No. 2001/0007275) and further as evidenced by Walter et al (US 3,354,646), as applied to claims 20 - 22 and further in view of Mori et al (US 6,136,214).

Regarding Claim 23: Suto et al in view of Yanagisawa et al and as evidenced by Walter et al teach all limitations of the claim except oxygen being supplied as an additional gas to plasma reactor or to the process chamber.

Mori et al teach a method for etching silicon oxide film on semiconductor substrates using ClF3 as an etching gas and where oxygen was also supplied as an additional gas (col. 20, lines 5-18).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to use oxygen as an additional gas supplied to the process chamber as taught by Mori et al in the apparatus of Suto et alin view of Yanagisawa et al and as evidenced by Walter et al for enhancing selective etching of silicon oxide films (column 20, lines 30-38).

Regarding Claim 26: Mori et al teach the plasma density used for etching is around 10.sup.11 -10.sup.12 particles/cm.sup.3 (col. 7, lines 20-30).

Claim 24 is rejected under 35 U.S.C. 103(a) as being unpatentable over Suto et al (NPL – Highly Selective Etching of Si3N4 to SiO2 Employing Fluorine and Chlorine Atoms Generated by Microwave Discharge – J. Electrochem. Soc., Vol. 136, No. 7, July 1989) in view of Yanagisawa et al (US PGPUB No. 2001/0007275) and further as evidenced by Walter et al (US 3,354,646) as applied to claims 14, 16-20, 22 and further in view of Ikeda et al (US 6,953,557).

Regarding Claim 24: Suto et al in view of Yanagisawa et al and as evidenced by Walter et al teach all limitations of the claim except a filter downstream from the plasma reactor for separating HF.

Ikeda et al teach a method where harmful gases like HF are removed from the etching gases like ClF3 using a removing apparatus (like a filter). Further, these removing apparatus (like stirring tank 5) are installed down stream of the plasma reactor (exhaust line 1) [col.1, lines 15-35 and col. 4, lines 10-60).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to use filter for separating/treating gases like HF as taught by Ikeda et al in the apparatus of Suto et al in view of Yanagisawa et al and as evidenced by Walter et al to separate out harmful components from the etching gases like ClF3.

Claim 25 is rejected under 35 U.S.C. 103(a) as being unpatentable over Suto et al (NPL – Highly Selective Etching of Si3N4 to SiO2 Employing Fluorine and Chlorine Atoms Generated by Microwave Discharge – J. Electrochem. Soc., Vol. 136, No. 7, July 1989) in view of Yanagisawa et al (US PGPUB No. 2001/0007275) and as evidenced by Walter et al (US 3,354,646), as applied to claims 14, 16-20, 22 and further in view of Ye et al (US 5,756,400).

Regarding Claim 25: Suto et al in view of Yanagisawa et al and as evidenced by Walter et al teach all limitations of the claim including supply of first gas and a second gas, and such that there is excess of fluorine, but do not teach that the fluoride atoms and chlorine atoms in the form of radicals or reactive species are present in the high density plasma at a 3: 1 ratio.

Ye et al teach a method for dry-clean etching of chamber internal surfaces, wherein a first gas (fluorine containing gas) and a second gas (chlorine containing gas) are introduced in a high density inductively coupled plasma reactor comprising a coil 40, matching network 30 and a

high frequency generator 28. Ye et al further teach that fluorine containing gas should be at least 50 % or greater and the chlorine containing gas should be minimum of 10 % to about 50%, which meets the claimed ratio of 3:1 (e.g. Fig. 2 and col. 7, line 10 to col. 8, line 5 and col. 11, line 40 to col. 15, line 15).

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to provide the fluoride atoms and chlorine atoms in the form of radicals or reactive species being present in the high density plasma at a 3: 1 ratio as taught by Ye et al in the apparatus and method of Suto et al in view of Yanagisawa et al and as evidenced by Walter et al to enable form chlorine trifluoride.

Claim 27 is rejected under 35 U.S.C. 103(a) as being unpatentable over Suto et al (NPL – Highly Selective Etching of Si3N4 to SiO2 Employing Fluorine and Chlorine Atoms Generated by Microwave Discharge – J. Electrochem. Soc., Vol. 136, No. 7, July 1989) and as evidenced by Walter et al (US 3,354,646).

Regarding Claim 27: Suto et al teach all limitations of the claim (as already explained above under claim 20) including a method wherein a first gas (NF3) and a second gas (Cl2) react with one another under the influence of high density plasma and that during plasma discharge, F and Cl atoms and inter-halogen molecules (like FCl) are generated which are then transported into the reaction chamber (e.g. Suto et al - Fig. 1 and pages 2032-2034).

Suto et al also does not teach except that a ratio of the first gas flow to the second gas flow is selected to achieve an ideal stochiometric conversion to chlorine trifluoride.

Though Suto et al in view of Yanagisawa et al do not explicitly teach that the method produces chlorine trifluoride, the prior art method would inherently produce chlorine trifluoride, since in such a reaction, few molecules of various reactive species including ClF3 would also be inherently produced besides FCl, especially since the claim does not recite any specific process conditions, except for use of a microwave plasma apparatus and use of two gases, which are also disclosed by the prior art apparatus and method of Suto et al in view of Yanagisawa, including use of same gases (viz. NF3 and Cl2) as also evidenced by the reference cited hereunder..

Walter et al teach a method using plasma discharge using a first gas (F2) and a second gas (Cl2) which react with one another under the influence of plasma discharge to generate ClF3 (besides ClF5). Walter et al also teach that besides other factors, relative concentrations of fluorine and chlorine atoms should be such as to enable production of ClF5 and preferably there should be excess of fluorine {e.g. col. 1, line 40 to col. 4, line 55). Since Suto et al teach that under the action of high density plasma interhalogen molecules are produced when a first gas (containing fluorine atoms) and and a second gas (containing chlorine atoms) are supplied to the plasma tube, it would have been obvious to generate chlorine trifluoride in the apparatus of Suto et al in view of Yanagisawa et al, by controlling process parameters like flow rates of the two gases etc, in view of teaching of Walter et al. Further, Walter et al also teach **that a ratio of the first gas flow to the second gas flow is selected to achieve an ideal stochiometric conversion to chlorine pentafluoride. It would be obvious to select the ratio of the first gas flow to the second gas flow to achieve an ideal stochiometric conversion to chlorine trifluoride.**

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to use control process parameters like flow ratio of the first and the second gases as

taught by Walters et al in the apparatus of Suto et al to enable generate chlorine trifluoride with ideal stochiometric convrersion.

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Claim 28 is rejected under 35 U.S.C. 103(a) as being unpatentable over Suto et al (NPL – Highly Selective Etching of Si3N4 to SiO2 Employing Fluorine and Chlorine Atoms Generated by Microwave Discharge – J. Electrochem. Soc., Vol. 136, No. 7, July 1989) and as evidenced by Walter et al (US 3,354,646) as applied to claim 27 and further in view of Yamazaki et al (US 5,641,380).

Regarding Claim 28: Suto et al as evidenced by Walter et al teach all limitations of the claim including that chlorine trifluoride is supplied to a process chamber 1, but do not teach that the flow rate of chlorine trifluoride to the process chamber is greater than 100 sccm.

Yamazaki et al teach a method of etching a substrate in a process chamber wherein chlorine trifluoride is supplied at a flow rate of 500 sccm {col. 6, lines 15-25}. It would have been obvious to supply the chlorine trifluoride fom the plasma reactor to the process chamber at a flow rate of 500 sccm (which meets the claim limitation of "greater than 100 sccm") to enable etch a substrate.

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to control the flow rate of chlorine trifluoride as taught by Yamazaki et al in the apparatus of Suto et a and as evidenced by Walter et al to enable etch the substrate.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to RAKESH DHINGRA whose telephone number is (571)272-5959. The examiner can normally be reached on 8:30 - 5:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on 571-272-1435. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/R. D./
Examiner, Art Unit 1792

/Karla Moore/
Primary Examiner, Art Unit 1792